

SOME ALGAE OF LAKE CARL BLACKWELL, OKLAHOMA,
EXCLUSIVE OF THE DIATOMS

BY

JAMES MICKEY COOPER

Bachelor of Science

East Central State College

Ada, Oklahoma


1962

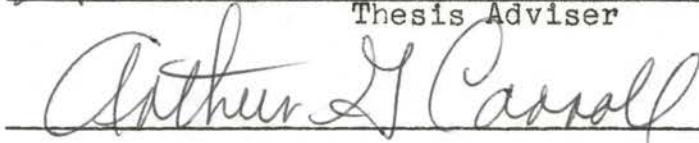
Submitted to the Faculty of the Graduate School
of the Oklahoma State University
in partial fulfillment of the
requirements for the
degree of
MASTER OF SCIENCE
May, 1965

MAY 28 1965

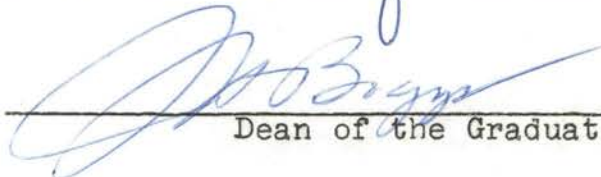
SOME ALGAE OF LAKE CARL BLACKWELL, OKLAHOMA,
EXCLUSIVE OF THE DIATOMS

Thesis Approved:


Thesis Adviser


Arthur I. Carroll


U. T. Waterfall


Dean of the Graduate School

ACKNOWLEDGEMENTS

The author wishes to take this opportunity to express his deepest appreciation to Dr. A. G. Carroll for his guidance, encouragement and constructive criticisms throughout this study.

The writer also wishes to thank Dr. W. W. Hansen and Dr. U. T. Waterfall for their valuable suggestions and help with the plan of study.

TABLE OF CONTENTS

Chapter	Page
I. INTRODUCTION	1
II. HISTORICAL REVIEW	4
III. STUDY REGION	9
Collecting Stations	10
IV. DISCUSSION	13
Collections	13
Temperature	14
pH	15
V. TAXONOMIC LIST	18
SUMMARY	22
SELECTED BIBLIOGRAPHY	23

LIST OF TABLES

Table	Page
I. Temperature, Centigrade, Recorded for the Collecting Stations	16
II. The pH Values Recorded for the Collecting Stations	17

LIST OF FIGURES

Figure	Page
1. Outline Map showing Locations of Collecting Stations	3
2. Photomicrograph of <u>Anabaena affinis</u> Lemm.	25
3. Photomicrograph of <u>Oscillatoria nigra</u> Vaucher	25
4. Photograph of colonies of <u>Gloeotrichia natans</u> (Hedw.) Raben	26
5. Photomicrograph of <u>Gloeotrichia natans</u> (Hedw.) Raben	26

CHAPTER I

INTRODUCTION

A review of the literature has failed to find any published reports of species determination of algae from Lake Carl Blackwell, Oklahoma, or from Payne County in which it is located. A survey of the algae found in this lake was the primary objective of this study. Data was obtained on the temperature and pH of the water at various collecting stations. Included is a list of the algae found, with illustrations of species thought to be new for the state.

The determinations of the various taxa were carried out by the use of available monographic treatments whenever possible. Handbooks and manuals concerning the algae were used for taxa on which monographs were not available. Representatives of the determinations are deposited at the Oklahoma State University. In a few instances, where poor specimen preservation was apt to occur, photomicrographs are deposited in lieu of specimens. In addition to the preserved material and photomicrographs, semi-permanent slides were made for selected specimens. These slides were prepared using glycerin jelly as a mounting medium and sealed with canada balsam.

The preservative used was formalin-acetic acid-alcohol (Prescott 1954). This mixture consisted of 50 cc. 95% alcohol,

5 cc. glacial acetic acid, 10 cc. commercial formalin and 35 cc. of water. Wide mouth vials with a capacity of about two ounces were found to be satisfactory for the collecting and storage of specimens. In most cases the material was preserved immediately upon returning from the field. Some collections were not preserved and were periodically examined for the production of sexual or asexual reproductive structures which would permit species determinations. The inclusion, in the taxonomic list, of a generic determination was the result of not having adequate reproductive structures.

On June 29, 1963, the first field trip was taken with a two-fold purpose, to select collecting stations and to secure specimens. Seven stations were selected to represent different habitats. The selections were made in order to obtain adequate samples from each type of exposure and habitat and to insure obtaining a maximum number of forms. On the next trip, July 13, three additional stations were added bringing the total to ten. The locations of the various stations are shown on an outline map (figure 1) obtained from the Oklahoma State Planning and Resources Board.

Seventeen separate collecting trips were taken during the course of one year with the procurement of 414 vials of material. Dates of the individual trips were: June 29, July 13, July 28, August 12, August 26, September 8, September 22, October 6, October 19, November 9, December 9, 1963, January 25, February 29, April 3, May 14, June 6, June 25, 1964.

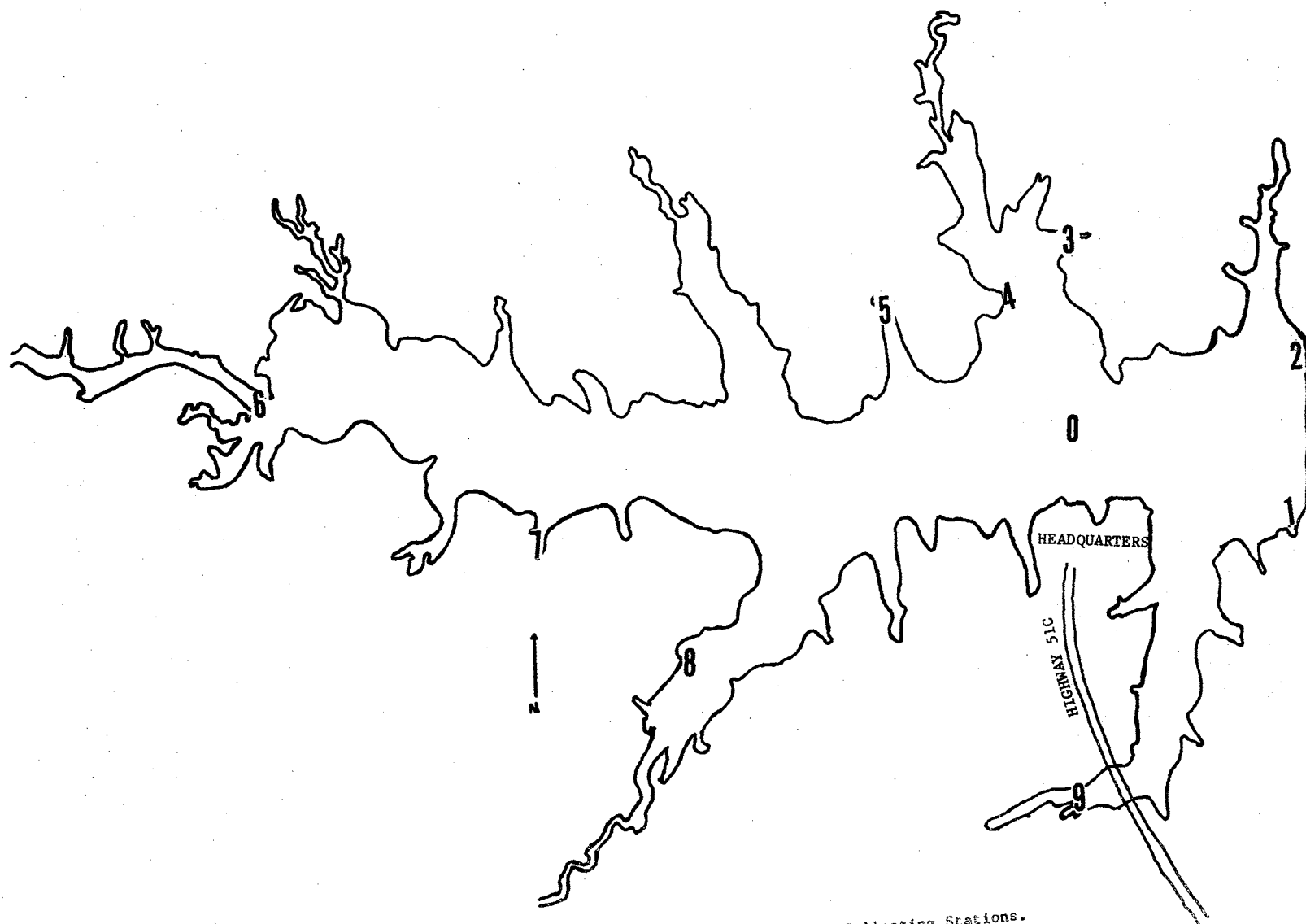


Fig. 1. Outline Map Showing Locations of Collecting Stations.

The use of a boat, equipped with a motor, greatly facilitated the collecting and made available many areas of the lake which otherwise would have been inaccessible. However, high winds on a few collecting trips prevented the sampling of all stations. Two different types of plankton tow nets were used on occasion during this study. One type consisted of a heavy canvas material, the other being number 20 bolting silk cloth. The latter net proved to be highly desirable over the former because many smaller forms and greater numbers of plankton were obtained using the silk net. Littoral collections were made by wading into the water and scraping rocks, stems and leaves of aquatic spermatophytes and other submerged objects.

The surface, 1-2 inches, temperatures of the water at the stations were measured to the nearest degree centigrade. The pH was determined immediately upon returning from the field using a Beckman pH meter. Samples for pH readings were collected in vials completely filled with water and tightly closed. This was done in order to prevent the diffusion of gases into the water which might alter the pH.

CHAPTER II

HISTORICAL REVIEW

In 1929 C. E. Taft undertook a survey of the algae within the state. His early work was limited to specific groups and resulted in a series of published reports concerning these. His reports were: the Desmids (1931, 1934, 1937), the Zygnemataceae (1934b), the Oedogoniaceae (1935), and Vaucheria (1937b). Additions to the algae of Oklahoma were reported by Taft (1940).

Taft, in his reports on the Desmids (1931, 1934, 1937) presented a list of species, varieties and forms along with illustrations. No information was given as to the sites of collections except in his first report of 1931 in which he listed 20 counties.

Transeau, et al. (1934) made a report of new species of the Zygnemataceae. Twenty-six new species and varieties were described from Oklahoma specimens by Transeau and Taft in this paper.

Taft (1935) in his paper on the Oedogoniaceae of Oklahoma, listed 64 species and varieties of the genera Bulbochaete and Oedogonium. In the treatment of this family Taft described 10 new species and varieties. Although his collections were

representative of the entire state Taft felt that the range of distribution of the two genera to be quite limited, this range coinciding closely with the shale and sandstone areas along the eastern border of Oklahoma. While present in small numbers, they never formed a conspicuous group in the prairie regions.

A report by Taft (1937b) on Vaucheria gave a description of one new species, Vaucheria discoidea Taft. The collection site being near Miami in Ottawa County.

Additions to the algae of Oklahoma were reported by Taft (1940). In this report he also included the counties from which the collections were made.

The publications previously mentioned and a report by Leake (1939), in which she described motile cells of Basicladia crassa Hoffman and Tilden, constitute the early work on Oklahoma algae.

Booth (1941, 1941b) studied algae as pioneers in plant succession in Kansas and Oklahoma. He listed 6 species encountered during his study. Only 2 species were listed specifically as occurring in Oklahoma, both of these from Cleveland County.

A study of the algae on the campus of Catholic College, Guthrie, Oklahoma, by Maloney (1944) added 105 species and varieties to the known algal flora of the state. All of her collections were from Logan County. Of the number listed 69 were diatoms, the remaining 36 representing the Cyanophyceae, Chlorophyceae and Euglenophyceae.

Leake (1945) reported on the algae of Crystal Lake, a 24 acre impoundment in Cleveland County. This study also included data on the physical and chemical properties of the water. Her taxonomic list contained 118 species and varieties which she stated were not previously known from the state. However, a comparison of the literature shows that 5 species and varieties listed by Leake as new records for the state had been previously reported by Maloney (1944). These are: Rhizoclonium crassipellitum W. & G. S. West, Closterium acerosum var. elongatum Breb., Phacus acuminatus Stokes, Trachelomonas volvocina Ehr. and Navicula gracilus Ehr.

Taft (1949) named and described 6 new species and varieties of algae collected from Oklahoma. Also he listed one additional species not recorded for the state.

A report on the genus Chara in Oklahoma by Ophel (1952) listed 8 species and varieties as occurring in the state. The counties from which collections were made are also cited. Herbarium specimens of Chara evoluta Allen, previously reported by Leake (1945), could not be located so were not included by Ophel in his paper.

Blum (1953) in a study of the racemose Vaucheriae listed 2 species as occurring in Oklahoma. These are Vaucheria hamata (Vauch.) DC and Vaucheria Walzi Rothert. Both of these collections came from near Ardmore.

Epizootic algae were reported by Vinyard (1955) with the addition of Dermatophyton radians Peter. to the known algae of the state. This collection came from the back of a turtle.

Also mentioned in this paper was a new undescribed species of Cladophora, found growing on the gills of several fish, but no description was given.

Vinyard (1958) presented a compendium of the algal flora based on his own collections plus those of previous investigators. This report also included notes on the geochemistry of the habitats in which his collections were made. He reported a total algal flora of 764 species, varieties and forms, exclusive of the diatoms. Maloney (1944) and Leake (1945) listed a total of 79 species and varieties of diatoms, if this number is added to that given by Vinyard the number of algae known from the state is 843.

CHAPTER III

STUDY REGION

Lake Carl Blackwell is located in Payne County, Oklahoma, 9 miles northwest of Stillwater. The impoundment was formed by the construction of a dam across Stillwater Creek. The dam was completed in 1937 and the basin completely filled with water in 1945. The basin covers an area of about 3200 acres and has many shallow arms which present a shore line of about 100 miles. The drainage area is about 14 times the size of the lake surface. The long axis of the lake lies east and west which is at right angles to the prevailing wind from the south.

The lake is located in the Redbeds Plains physiographic region as described by Bruner (1931). The soils of the region are fine and were derived from the Permian clays and shale. Locally the region is one of rolling hills with alternations of prairie and wooded areas.

Lake Carl Blackwell was the site of a limnological study by Leonard (1950) in which he presented data collected in 1940-41 and 1949-50. Turbidity readings were found to have increased during the period of his study. Leonard attributed this to be due to a decrease in hydrogen-ion concentration. The turbidity was found to be caused by montmorillonite clay

particles suspended in the water. Productivity and plankton counts were found to be less in 1949-50 than in 1940-41. Leonard felt this decline to be due to the increased turbidity. Temperatures varied from a low of 3.5° to a high of 28.5° centigrade. The water was found to be consistently alkaline during his study.

COLLECTING STATIONS

Station 0 was an open water site selected for euplankton collecting. The area was judged to be about over the center of the deeper water.

Station 1 was located at the south end of the dam next to the spillway. During the period of this study the water level did not exceed that of the spillway level. The area was well protected from southerly winds by a high bank and numerous trees. However, it was exposed to severe wave action from northerly winds. The bottom material was composed of a mixture of sand and large rocks. Chara Zeylanica Willdenow forma Michauxii (Braun) H. & J. Groves along with the spermatophyte Potamogeton nodosus Poiret were very abundant during the summer and fall of 1963, but had not developed in abundance by June 1964.

Station 2 located at the north end of the dam was subject to strong wave action. The bottom was composed of large rocks placed here to prevent the cutting action of waves on the earthen dam.

Station 3 was in a narrow cove well protected from wave action. The bottom was very muddy and supported dense mats of Chara. On several occasions localized "water blooms" occurred here. This site was particularly productive with regard to the number of different algae found here.

Station 4 was located in the same major arm of the lake as station 3 but differed in many respects. The bottom was composed almost entirely of small smooth stones. There was a very narrow ledge of shallow water along the edge of the shore which dropped abruptly to deep water. The site was exposed to winds from both the north and south. About the only littoral algae found here were attached filaments of Spirogyra, which were always sterile in the collections, and a few clumps of Chara.

Station 5 was situated in a small arm on the north side of the lake. This site was well protected from wave action. The bottom was very muddy and the water very shallow. On several occasions "water blooms" were present here. This site was similar to station 3 especially with regard to the collections of Cyanophyta which were very abundant.

Station 6 was located in the northwestern portion of the lake. This station was in the area where Stillwater Creek flows into the lake. The water surrounding this site was very shallow with a sandy bottom. This condition was probably due to the rapid deposition of the heavy suspended matter carried into the lake by runoff water in the stream. On all collecting trips, the water was very turbid with a reddish coloration. This was probably the result of suspended clay particles in the

water. As the land surface around this site was flat it was exposed to considerable wave action.

Station 7 was located on the south side of the lake in a small cove. The area was well protected from the south winds. The water was shallow with a firm sandy bottom.

Station 8 was also located on the south side of the lake. This site was exposed to wind from almost any direction as the land surface around the area was very flat. The bottom was very sandy. Only a few members of the Zygnemataceae and scattered clumps of Chara were found in the collections gathered from along the shore of this station.

Station 9 was located in a long arm of the lake that extended about a mile south of the main body of water. The exposure was to the south. The bottom was of mud with a few large chunks of concrete slabs from an old abandoned bridge. The water was very shallow for a considerable distance from the shore and was usually very turbid.

CHAPTER IV

DISCUSSION

COLLECTIONS

During the course of this study 33 species, varieties and forms in 24 genera representing 18 families of algae were recognized as occurring in Lake Carl Blackwell. A complete list of the algae encountered can be found in Chapter V. A tabular arrangement of the families with their number of representatives is given on page 21. The largest family was the Zygnemataceae with 5 species, followed by the Desmidiaceae, Hydrodictyaceae and Oscillatoriaceae with 4 representatives each.

Three species of algae were found in Lake Carl Blackwell that are thought not to have been previously reported as occurring in Oklahoma. These are: Anabaena affinis Lemm., Gloetrichia natans (Hedw.) Raben., and Oscillatoria nigra Vaucher. Photomicrographs of these species are to be found on Plates I and II.

Anabaena affinis Lemm., Plate I figure 2, was collected at station 5 on June 6, 1964. It occurred very abundantly in the surface water along with Botryococcus Braunii and Microcystis aeruginosa at this station but was not found elsewhere.

Gloeotrichia natans (Hedwig) Raben., Plate II figure 4-5, was found only at station 6. Specimens were obtained from July until September 1963. Many large mature colonies (up to 2.5 cm. in diameter) were found along the margin of the lake at this station.

Oscillatoria nigra Vaucher, Plate I figure 3, was collected from station 3 on October 6, and from station 5 on October 19, 1963. The trichomes were found growing on the muddy bottom and aggregated to form a dark-green mass.

An interesting feature on distribution within the lake is the fact that only 3 taxa were found to occur at all stations, except the euplankton site. These are: Chara Zeylanica Willdenow forma Michauxii (Braun) H. & J. Groves, Cladophora aegagropila Kuetzing and Spirulina major Kuetzing. The first two species were found growing attached to the bottom or to some submerged object. The third species was collected as a tychoplankter.

TEMPERATURE

The recorded seasonal range of the temperature of the surface water, 1-2 inches, at the various collecting stations was 4° C. in January to 33° C. in July, August and September. Parts of the lake during January 1964 were frozen over. No collections were made or physical and chemical measurements taken while ice cover was present. The temperatures with the date they were recorded are listed in Table I.

pH

The pH of the water at the various stations was consistently alkaline, pH 7.6-8.8. The recorded pH values and average values (to the nearest tenth) are given in Table II. Very little variation in average pH values among the ten collecting stations was found, pH 8.3-8.5.

TABLE I
TEMPERATURE, CENTIGRADE, RECORDED
FOR THE COLLECTING STATIONS

Date	Station no.									
	1	2	3	4	5	6	7	8	9	0
6-29-63	--	--	--	--	--	--	--	--	--	--
7-13-63	27	28	28	--	28	29	28	32	33	--
7-28-63	28	28	31	30	33	33	29	--	28	30
8-12-63	30	29	31	31	31	32	30	30	31	30
8-26-63	27	27	28	28	29	31	30	30	33	30
9- 8-63	28	29	29	29	29	32	31	33	32	29
9-22-63	26	27	27	27	27	29	28	31	31	27
10- 6-63	21	22	23	24	24	24	24	24	25	24
10-19-63	22	22	22	22	22	23	22	21	23	22
11- 9-63	20	20	19	18	18	19	20	17	18	19
12- 7-63	9	10	9	---	--	--	--	--	9	--
1-25-64	6	4	5	5	4	5	6	4	8	4
2-29-64	5	5	--	--	--	--	--	--	4	--
4- 3-64	14	15	19	14	--	--	--	--	18	13
5-14-64	21	21	22	21	--	--	--	21	22	--
6- 6-64	23	26	26	24	27	30	22	27	27	22
6-25-64	28	29	29	29	31	31	31	31	29	29

TABLE II
THE pH VALUES RECORDED FOR
THE COLLECTING STATIONS

Date	Station no.									
	1	2	3	4	5	6	7	8	9	0
6-29-63	---	---	---	---	---	---	---	---	---	---
7-13-63	8.3	8.2	8.4	8.5	8.7	8.6	8.5	8.6	---	---
7-28-63	8.1	8.2	8.2	8.1	8.2	8.3	8.3	---	8.3	8.5
8-12-63	7.8	7.8	7.8	7.8	7.8	8.0	7.8	7.6	8.1	7.8
8-26-63	7.8	7.9	8.0	8.1	8.1	8.2	8.2	8.2	8.2	8.1
9- 8-63	8.4	8.5	8.7	8.7	8.7	8.7	8.8	8.7	8.8	8.7
9-22-63	8.4	8.4	8.3	8.5	8.4	8.5	8.6	8.6	8.6	8.5
10- 6-63	8.2	8.2	8.3	8.4	8.2	8.3	8.6	8.3	8.1	8.5
10-19-63	7.9	8.1	8.1	8.2	8.3	8.2	8.3	8.1	8.4	8.0
11- 9-63	8.5	8.8	8.7	8.8	8.8	8.7	8.8	8.7	8.7	8.6
12- 7-63	8.5	8.8	8.6	---	---	---	---	---	8.7	---
1-25-64	8.8	8.8	8.8	7.9	8.5	8.8	8.6	8.7	8.8	8.7
2-29-64	8.2	8.3	8.6	---	---	---	---	---	8.5	---
4- 3-64	8.4	8.6	8.5	8.6	---	---	---	---	8.5	8.4
5-14-64	8.2	8.4	8.5	8.5	---	---	---	---	8.0	---
6- 6-64	8.6	8.6	8.5	8.6	8.6	8.8	8.8	8.8	---	8.6
6-25-64	8.4	8.3	---	8.4	8.5	8.3	8.5	8.5	8.6	8.6
Average	8.3	8.4	8.4	8.4	8.4	8.5	8.5	8.4	8.5	8.4

CHAPTER V

TAXONOMIC LIST

Those species preceded by an asterisk are thought to be new records for Oklahoma. The reference following each family is the authority used in determining the taxa in that group. The number following each name in the list refers to the number of the representative specimen on deposit at the Oklahoma State University.

CHLOROPHYTA

VOLVOACEAE (Smith, 1920)

Eudorina elegans Ehr. - 16

Pandorina morum (Muell.) Bory - 30

PAUMELLACEAE (Prescott, 1962)

Gleocystis gigas (Kuetz.) Lagerheim - 23

CHATOPHORACEAE (Prescott, 1962)

Aphanochaete repens A. Braun - 32

PROTOCOCCACEAE (Prescott, 1962)

Protococcus viridis Agardh - 6

CLADOPHORACEAE (Forest, 1954)

Cladophora aegagropila Kuetzing - 4

OEDOGONIACEAE (Tiffany, 1937)

Bulbochaete sp. - 20Oedogonium gracilius (Wittr.) Tiffany - 18

HYDRODICTYACEAE (Prescott, 1962)

Pediastrum duplex Meyen var. duplex - 34Pediastrum duplex Meyen var. gracilium West & West - 13Pediastrum duplex Meyen var. reticulatum Lagerheim - 14Pediastrum simplex (Meyen) Lemm. var. duodenarium - 12
(Bailey) Raben.

COELASTRACEAE (Prescott, 1962)

Coelastrum reticulatum (Dang.) Senn - 22

BOTRYOCOCCACEAE (Prescott, 1962)

Botryococcus Braunii Kuetzing - 28

OOCYSTACEAE (Prescott, 1962)

Planktosphaeria gelatinosa G. M. Smith - 15

ZYGNEMATAACEAE (Transeau, 1951)

Spirogyra fluviatilis Hilse - 8Spirogyra majuscula Kuetzing - 29Spirogyra neglecta (Hassall) Kuetzing - 9Spirogyra reticulata Nordstedt - 5Spirogyra setiformis (Roth) Kuetzing - 3

DESMIDIACEAE (Forest, 1954, Smith, 1924)

Closterium gracile DeBreb. var. elongatum West & West - 33Closterium moniliferum (Bory) Ehr. - 7

Cosmarium subcrenatum Hantzsch. - 21

Staurostrum chaetoceras (Schroder) G. M. Smith - 19

CHARACEAE (Ophel, 1952)

Chara Zeylanica Willdenow forma Michauxii (Braun) H. & J. Groves - 2

PYRROPHYTA

CERATIACEAE (Prescott, 1962)

Ceratium hirundinella (Muell.) Dujardin - 11

CYANOPHYTA

CHROOCOCCACEAE (Prescott, 1962)

Microsystis aeruginosa Kuetzing emend. Elenkin - 31

OSCILLATORIACEAE (Prescott, 1962)

Oscillatoria limosa (Roth) Agardh - 26

*Oscillatoria nigra Vaucher - 10

Oscillatoria princeps Vaucher - 24

Spirulina major Kuetzing - 17

NOSTOCACEAE (Prescott, 1962)

*Anabaena affinis Lemmermann - 27

Aphanizomenon flos-aquae (L) Ralfs - 25

RIVULARIACEAE (Prescott, 1962)

*Gloeotrichia natans (Hedw.) Raben. - 1

TABULAR VIEW OF FAMILIES

Family	Genera	Species, varieties and forms
Volvocaceae	2	2
Palmellaceae	1	1
Chatophoraceae	1	1
Protococcaceae	1	1
Cladophoraceae	1	1
Oedogoniaceae	2	1
Hydrodictyaceae	1	4
Coelastraceae	1	1
Botryococcaceae	1	1
Oocystaceae	1	1
Zygnemataceae	1	5
Desmidiaceae	3	4
Characeae	1	1
Ceratiaceae	1	1
Chroococcaceae	1	1
Oscillatoriaceae	2	4
Nostocaceae	2	2
Rivulariaceae	1	1
Totals	24	33

SUMMARY

A survey of the algae found in Lake Carl Blackwell, Payne County, Oklahoma, was the primary objective of this study. Ten collecting stations were selected and from these 414 vials of material were collected for study. Physical and chemical measurements of the water were taken at collecting stations.

Thirty-three species, varieties and forms in 24 genera representing 18 families of algae were found in Lake Carl Blackwell. A list of the taxa encountered is included in this study. Representative specimens or photomicrographs are deposited at the Oklahoma State University.

Three species of algae were found that are not thought to have been previously reported as occurring in Oklahoma. These are: Anabaena affinis Lemm., Gloeotrichia natans (Hedw.) Raben., and Oscillatoria nigra Vaucher. Photomicrographs of these species are included in this thesis.

Physical and chemical measurements showed the water of the collecting stations to be consistently alkaline, pH 7.6-8.8, and having a seasonal range of temperature from 4° to 33° centigrade.

SELECTED BIBLIOGRAPHY

- Blum, J. L. 1953. The racemose Vaucheriae with inclined or pendent oogonia. Bull. Torr. Bot. Club. 80: 478-497.
- Booth, W. E. 1941. Algae as pioneers in plant succession and their importance in erosion control. Ecol. 22: 38-46.
- Booth, W. E. 1941b. Revegetation of abandoned fields in Kansas and Oklahoma. Amer. Jour. Bot. 28: 38-46.
- Bruner, W. E. 1931. The vegetation of Oklahoma. Ecol. Monogr. 1: 99-188.
- Forest, H. S. 1954. Handbook of algae. University of Tennessee Press. Knoxville.
- Leake, D. V. 1939. Preliminary notes on the production of motile cells in Basicladia crassa Hoffman and Tilden. Proc. Okla. Acad. Sci. 19: 109-110.
- Leake, D. V. 1945. The algae of Crystal Lake, Cleveland County, Oklahoma. Amer. Midland Nat. 34: 750-768.
- Leonard, E. M. 1950. Limnological and successional changes of Lake Carl Blackwell, Oklahoma. Unpublished Ph. D. dissertation. Oklahoma State University.
- Maloney, M. (Sister) 1944. Seasonal algal flora on the campus of Catholic College, Guthrie, Oklahoma. Proc. Okla. Acad. Sci. 24: 43-48.
- Ophel, I. L. 1952. The genus Chara in Oklahoma. Proc. Okla. Acad. Sci. 33: 179-183.
- Prescott, G. W. 1954. How to know the fresh-water algae. Wm. C. Brown Company. Dubuque, Iowa.
- Prescott, G. W. 1962. Algae of the western great lakes area. Wm. C. Brown Company. Dubuque, Iowa.
- Smith, G. M. 1920. Phytoplankton of the inland lakes of Wisconsin I. Bull. Wis. Geol. Nat. Hist. Surv. 57. Madison.

- Smith, G. M. 1924. Phytoplankton of the inland lakes of Wisconsin II. Bull. Wis. Geol. Nat. Hist. Surv. 57. Madison.
- Smith, G. M. 1950. The fresh-water algae of the United States. 2nd. ed. McGraw Hill. New York.
- Smith, G. M. 1951. Manual of phycology. Chronica Botanica Company. Waltham, Mass.
- Taft, C. E. 1931. Desmids of Oklahoma. Publs. Univ. of Okla. Biol. Surv. 3(3): 277-321.
- Taft, C. E. 1934. Desmids of Oklahoma II. Trans. Amer. Micros. Soc. 53(2): 95-321.
- Taft, C. E. 1935. The Oedogoniaceae of Oklahoma including new species and varieties. Bull. Torr. Bot. Club. 62: 281-290.
- Taft, C. E. 1937. Desmids of Oklahoma III. Trans. Amer. Micros. Soc. 56(4): 397-404.
- Taft, C. E. 1937b. A new species of Vaucheria. Bull. Torr. Bot. Club. 64: 557.
- Taft, C. E. 1940. Additions to the algae of Oklahoma. Proc. Okla. Acad. Sci. 20: 49-54.
- Taft, C. E. 1949. New, rare, or otherwise interesting algae. Trans. Amer. Micros. Soc. 68(3): 208-216.
- Tiffany, L. H. 1937. The Oedogoniales in North America. North Amer. Flora. 11: 1-102.
- Transeau, E. N., et al. 1934. New species of Zygnemataceae. Trans. Amer. Micros. Soc. 53(3): 208-230.
- Transeau, E. N. 1951. The Zygnemataceae. Ohio State University Press. Columbus.
- Vinyard, Wm. C. 1955. Epizoophytic algae from mollusks, turtles and fish in Oklahoma. Proc. Okla. Acad. Sci. 34: 63-65.
- Vinyard, Wm. C. 1958. The algae of Oklahoma. (exclusive of diatoms) Unpublished Ph. D. dissertation. Michigan State University.

PLATE I



Fig. 2. Photomicrograph of Anabaena
affinis Lemm. X 1330



Fig. 3. Photomicrograph of Oscillatoria
nigra Vaucher X 388

PLATE II



Fig. 4. Photograph of colonies of Gloeotrichia natans (Hedw.) Raben.

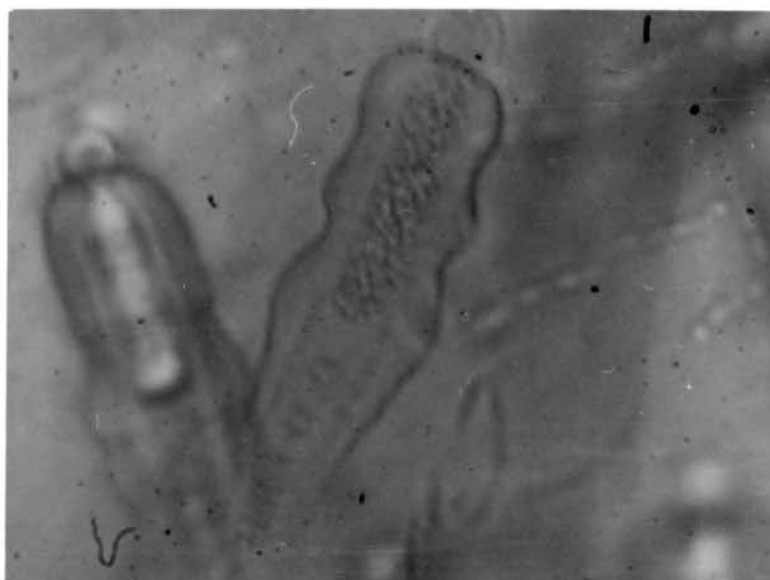


Fig. 5. Photomicrograph of Gloeotrichia natans (Hedw.) Raben. X 1250

VITA

James Mickey Cooper

Candidate for the Degree of
Master of Science

Thesis: SOME ALGAE OF LAKE CARL BLACKWELL, OKLAHOMA
EXCLUSIVE OF THE DIATOMS

Major Field: Botany

Biographical:

Personal data: Born near Centrahoma, Oklahoma,
March 29, 1940, the son of Sonnie and Edna Maurice
Cooper.

Education: Graduated from Tupelo High School in 1958,
Tupelo, Oklahoma; received the Bachelor of Science
Degree in Education from East Central State College,
Ada, Oklahoma, with a major in Biology, in 1962.

Professional Experience: Served as a graduate teaching
assistant in Botany at the Oklahoma State Univer-
sity 1963-64.

Professional Organizations: Member of the Oklahoma
Academy of Science and Phi Sigma.